INFRARED FOCAL PLANE ARRAY DETECTOR AND METHOD OF PRODUCING THE SAME

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to an infrared focal plane array detector and a method of producing the same, and more particularly to an infrared focal plane array detector which is less likely to be influenced by an offset signal and a temperature drift and a method of producing the same.

2. Description of the Related Art

A bolometer detector has a resistance value which varies in response to a temperature variation, and is used widely for detection of infrared rays with the characteristic made most of. A mechanism of operation of a conventional infrared focal plane array detector which employs a bolometer detector and is an example of an application is described with reference to FIG. **1**.

A plurality of unit cells **400** each including one bolometer detector **401** are arranged in a two-dimensional array in FPA (FOCAL PLANE ARRAY) **417** such that they may form columns and rows. Bolometer detector **401** in each unit cell **400** is connected to ground terminal **403** through unit cell selecting transistor or switch **402**. The gate electrodes of unit cell selecting switches **402** are controlled by vertical shift register **410** through horizontal lines **406** and are selected such that all of the unit cell selecting switches **402** connected to one horizontal lines **406** may be put into a closed state. Consequently, on each vertical line **404**, bolometer detector **401** on one of the unit cells **400** is selectively connected to ground terminal **403**.

Vertical lines **404** are connected to an on-chip amplifier **407** through vertical line selection switches **405** and over to output line **421**. Vertical line selection switches **405** are controlled by horizontal shift register **409** such that one of vertical lines **404** may be connected to an on-chip amplifier **407** at a given time.

A light receiver of each bolometer detector **401** is in a high thermally insulating state with respect to asubstrate, and consequently, thermal energy by infrared radiation is temporarily stored into bolometer detector **401**. As a result, the temperature of bolometer detector **401** rises, and a resistance variation corresponding to the temperature variation appears with bolometer detector **401**. Temperature information of an image pickup object can be obtained by externally reading out the resistance variation through output terminal **408**.

For the readout circuit, for example, integration circuit **440** is used. In integration circuit **440**, electric current flowing through integration transistor **441** while a fixed voltage is applied to bolometer detector **401** for a fixed time is integrated by means of integrating capacitor **442**. Actually, integrating capacitor **442** connected in series to bolometer detector **401** is charged up to a predetermined voltage in advance, and then, after integrating capacitor **442** is energized with the fixed voltage for a fixed time, the remaining voltage of integrating capacitor **442** is read out. Integration transistor **441** acts to keep the voltage of output terminal **408** fixed even if the terminal voltage of integrating capacitor **442** varies during the integration operation. Accordingly, the remaining voltage of integrating capacitor **442** after the integration operation comes to an end depends upon the resistance value of bolometer detector **401** within the integration period and includes information regarding the amount of heat radiation received from the image pickup object. Information of the infrared radiation amount can be read out electrically in this manner.

The infrared focal plane array detector which employs a bolometer element described above, however, has a problem in that offset components of the output signal are so high that a sufficient gain cannot be obtained. A principal part of the offset components of the signal arises from a large variation of the bolometer resistance by a temperature rise caused by joule heating of the bolometer detector within the integration period. Although the offset components occupy the greater part of the output signal, it does not include temperature information of the object at all. Therefore, the dynamic range of an amplifier cannot be used effectively, and the signal gain cannot be raised. If the integration time is increased, then the temperature resolution is augmented as much. However, since this increases also the offset amount simultaneously, a sufficient integration time cannot be assured.

The infrared focal plane array detector which employs a bolometer described above has another significant problem in temperature drift. Although each bolometer detector is thermally isolated from the substrate, actually a little heat exchange with the substrate is present through signal readout wires. Therefore, if the ambient temperature varies and the substrate temperature varies, then the element temperature of the bolometer detector varies with a long time constant. This makes a cause of a temperature drift. In order to prevent this, FPN (FIXED PATTERN NOISE) correction must be performed frequently during operation, and this significantly deteriorates the operability of an infrared camera which employs the infrared detector.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a new infrared focal plane array detector which eliminates the drawbacks of the prior art described above and particularly removes an offset and eliminates an influence of a temperature drift thereby to augment the accuracy in detection of infrared rays and a method of producing the infrared focal plane array detector.

An-infrared focal plane array detector of the present invention comprises first bolometer detectors and at least one set of second bolometer detectors and a plurality of third bolometer detectors being provided on the same substrate. First bolometer detectors have, between the first bolometer detectors and a substrate, a thermal isolation structure for thermally isolating the first bolometer detectors and the substrate from each other and disposed in an infrared detection area on the substrate for receiving infrared rays incoming thereto. Second bolometer detectors have a thermal isolation structure between the second bolometer detectors and the substrate for thermally isolating the second bolometer detectors from the substrate and are so structured as to receive no infrared rays incoming to the infrared focal plane array detector. Third bolometer detectors are directly